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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Ruutu, et al.

Serial No. TO BE ASSIGNED

Corresponding to PCT/EP97/07351, filed 30 December 1997

Filed: 29 June 2000

Docket No.: 975.306USW1

Title: BROADBAND CELLULAR NETWORK DEVICE



CERTIFICATE UNDER 37 C.F.R. 1.10:

'Express Mail' mailing number: EL477365768US

Date of Deposit: 29 June 2000

The undersigned hereby certifies that this Transmittal Letter and the paper or fee, as described herein, are being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231

By:

Missy Lange

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

REQUEST FOR CONTINUATION OF AN INTERNATIONAL APPLICATION UNDER 37 C.F.R. §1.53(b)

This is a request for filing a continuation application under 37 C.F.R. §1.53(b) of prior pending international application number PCT/EP97/07351 filed on 30 December 1997 entitled BROADBAND CELLULAR NETWORK DEVICE, which designated the United States.

1. ☒ Enclosed is a patent application containing 11 pages of specification, 3 pages of claims and 2 sheet(s) of drawings.
2. ☒ A preliminary amendment is enclosed.
3. ☒ Please amend the specification by inserting the following paragraph after the title:

This application is a continuation of international application serial number PCT/EP97/07351, filed 30 December 1997.
4. ☐ Small entity status
 - a. ☐ A small entity statement is enclosed.
 - b. ☐ A small entity statement was filed in the prior non provisional application.
 - c. ☐ is no longer claimed.

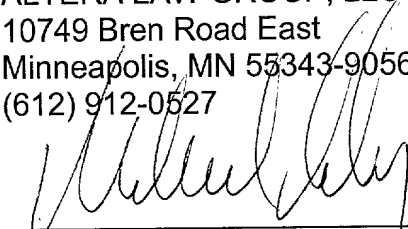
The filing fee is calculated below

CLAIMS				
	Number Filed	Number Extra	Rate	Fee
Total Claims	8	0	X \$18.00	\$
Indep. Claims	2	0	X \$78.00	\$
Multiply Dependent Claims				\$
Basic Fee				\$ 690.00
TOTAL				\$ 690.00

5. ☒ Payment of filing fees
☐ A check in the amount of _____ is enclosed.
☐ Please charge Deposit Account Number 50-1038.
☒ Is deferred.
6. ☒ The Commissioner is hereby authorized to credit any overpayment or charge any fees required under 37 C.F.R. §1.16-1.18 to Deposit Account Number 50-1038.
7. ☐ The priority of _____ application number _____, filed _____, is claimed under 35 U.S.C. §119.
8. ☒ An unsigned Declaration is enclosed.
9. ☐ An assignment of the invention to _____, Recordation Form Cover Sheet (Patents Only) and a check in the amount of \$40.
10. ☐ An Information Disclosure Statement, Form PTO 1449 and copies of _____ citations are enclosed.
11. ☒ Correspondence Address
- Alterra Law Group
10749 Bren Road East
Minneapolis, Minnesota 55343
12. ☒ Address all correspondence to Michael B. Lasky.
13. ☐ Also enclosed:
14. ☒ A return postcard is enclosed.

Respectfully submitted,

ALTERA LAW GROUP, LLC
10749 Bren Road East
Minneapolis, MN 55343-9056
(612) 912-0527



Michael B. Lasky
Atty. Reg. Number 29,555
MBL/mka

Dated: 29 June 2000

S/N UNKNOWN

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Ruutu, et al. Serial No.: UNKNOWN
Filed: CONCURRENT HERewith Docket No.: 975.306USW1
Title: BROADBAND CELLULAR NETWORK DEVICE

CERTIFICATE UNDER 37 CFR 1.10

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I hereby certify that this correspondence is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

By: 

Name: Missy Lange

PRELIMINARY AMENDMENT

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Please enter the following preliminary amendment into the above-referenced application.

ABSTRACT

Please insert the attached abstract into the application as the last page thereof.

CLAIMS

Please amend the claims as follows:

In claim 5, line 1, please replace "according to one of claims 3 or 4" with –
according to claim 3--.

REMARKS

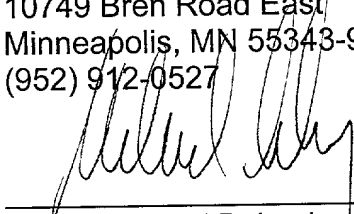
The above preliminary amendment is made to insert an abstract page into the application and to remove multiple dependencies from claims 3.

Applicant respectfully requests that this preliminary amendment be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above-identified application.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicant's attorney of record, Michael B. Lasky at (952) 912-0527.

Respectfully submitted,

ALTERA LAW GROUP, LLC
10749 Bren Road East
Minneapolis, MN 55343-9056
(952) 912-0527



Michael B. Lasky
Atty. Reg. Number 29,555
MBL/mka

Dated: 29 June 2000

BROADBAND CELLULAR NETWORK DEVICE

FIELD OF THE INVENTION

The present invention relates to a device for controlling
5 cellular traffic in a mobile communication system based on
asynchronous transfer mode technology, and also concerns a
base station controller using this device.

BACKGROUND OF THE INVENTION

10 In recent years, the Global System for Mobile Communications
(GSM) and other cellular networks have grown rapidly all over
the world. An accordingly increasing number of subscribers
has led to a corresponding increase of bandwidth in trunking
15 networks of cellular systems such as base station subsystems
(BSS) in the GSM.

Fig. 5a and 5b schematically show examples of parts of trunk-
ing networks in mobile communication systems. In such trunk-
20 ing networks, a mobile services switching center MSC and an
associated visitor location register VLR are linked to a base
station controller BSC. The base station controller BSC is in
turn linked to a base transceiver station BTS, which is cou-
pled with mobile stations (not shown) at respective end us-
25 ers. The base station controller BSC and the base transceiver
station BTS constitute a so called base station subsystem
BSS, which is indicated by dashed lines in Fig. 5a and 5b.

In more detail, in Fig. 5a part of a conventional pulse code
30 modulation (PCM) based trunking network is illustrated, in
which the coupling links, i.e. the connections between net-

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work elements, and the switching in the base station controller BSC are all PCM based.

However, the integration of mobile stations such as mobile
5 phones and data communication has recently given rise to the
introduction of new data services like e.g. the Short Message
Service (SMS) or the access to the Internet using a mobile
station. Along therewith, an increasing demand for replacing
these conventional narrow banded PCM networks with broadband
10 communication systems can now be observed.

As a future data transfer technology for use in broadband
communication systems, asynchronous transfer mode, in short
also referred to as ATM, has been proposed.

15 The basic idea of asynchronous transfer mode is to transfer
data in small data packets having a fixed size. These data
packets are called cells. A flow of such cells represents a
virtual channel connection VCC between respective end users.
20 The virtual nature of the connection arises from the fact
that cells are transferred only when there are data to be
sent. In contrast to known connection-oriented systems,
therefore, resources are not used when no useful payload is
present.

25 Asynchronous transfer mode is also suitable for transferring
packet data in e.g. GSM networks. In this respect, General
Packet Radio Services (GPRS) have been proposed, in which
data packets like e.g. IP traffic are transferred through GSM
30 radio interface.

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However, with a conventional PCM based base station subsystem as shown in Fig. 5a, such data packets must first be transformed into PCM format in the base transceiver station BTS and then retransformed into packet format before being sent to public packet data networks like e.g. the Internet. The same transformations must also be made for data packets traveling in the opposite direction, i.e. from the public data networks to the base transceiver station BTS. By use of asynchronous transfer mode procedures, this data transformation can be avoided, and it is moreover possible to directly route data packets in asynchronous transfer mode cells from the base station subsystem BSS to public asynchronous transfer mode based networks.

In order to use asynchronous transfer mode in the trunking network of a GSM system, at least the conventional PCM links between respective network elements must be replaced with ATM links. In the resulting arrangement, ordinary PCM based GSM network elements are then connected by ATM links, for which an example is shown in Fig. 5b.

Such a technique is called Circuit Emulation Services (CES), which, however, is not yet an effective realization of ATM, since the base station controller BSC and, thus, the base station subsystem BSS do in this case not support ATM switching.

Therefore, it is an object of the present invention to provide a device which is capable of supporting ATM switching at base station subsystem level and, thus, implements an effective

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tive realization of asynchronous transfer mode in mobile communication networks.

In view of the future expansions expected in such mobile communication networks, the present invention shall also provide a device which can be manufactured, installed and maintained at low cost. Asynchronous transfer mode technology may also provide a big increase in capacity when compared with PCM technology. Thus, the number of physical lines in base station subsystems can be reduced.

According to the present invention, this object is accomplished by a broadband cellular network device, comprising a base station control unit adapted to control the distribution of asynchronous transfer mode cellular traffic consisting of asynchronous transfer mode cells, an asynchronous transfer mode controller connected to and being controlled by said base station control unit, and an asynchronous transfer mode switching means connected to and being controlled by said asynchronous transfer mode controller and adapted to switch asynchronous transfer mode cellular traffic.

With the above configuration, an asynchronous transfer mode based broadband cellular network device is implemented by combining the functions of a base station controller unit with an asynchronous transfer mode switch.

The device is capable of performing asynchronous transfer mode switching in a base station subsystem and moreover represents an inexpensive basis for an asynchronous transfer

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mode based base station controller for use in asynchronous transfer mode based cellular networks.

Further embodiments of the present invention are subject of
5 the attached dependent claims.

Preferably, said base station unit provides either of a software, hardware or mixed software/hardware implementation of base station controller functions and comprises an asynchronous transfer mode controller instruction means.
10

The asynchronous transfer mode controller is arranged to provide an interface for converting commands issued by the base station controller unit into commands causing switching actions of the asynchronous transfer mode switching means.
15

Advantageously, the asynchronous transfer mode controller is adapted to employ asynchronous transfer mode based signalling and to provide control commands for controlling connecting hardware of the asynchronous transfer mode switching means.
20

According to a further development, the asynchronous transfer mode controller is arranged to comprise at least two functional layers, one of the functional layers being a cellular network related upper layer adapted to perform cellular network related functions, and one of the functional layers being an asynchronous transfer mode related lower layer adapted to perform asynchronous transfer mode switching means related functions.
25

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Thereby, the lower functional layer of the asynchronous transfer mode controller is advantageously arranged to control the switching hardware of the asynchronous transfer mode switching means.

5

In addition, the asynchronous transfer mode controller may be adapted to be a General Switch Management Protocol controller. Then, the asynchronous transfer mode switching means is adapted to support said General Switch Management Protocol.

10

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be described in greater detail by way of preferred embodiments with reference to the accompanying drawings, in which:

Fig. 1 schematically illustrates a mobile communications network using asynchronous transfer mode links and asynchronous transfer mode switching;

Fig. 2 illustrates the broadband cellular network device according to a first preferred embodiment;

Fig. 3 illustrates the broadband cellular network device according to a second preferred embodiment;

Fig. 4 illustrates the broadband cellular network device according to a third preferred embodiment;

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Fig. 5a schematically shows part of a known mobile communications network using PCM links and PCM switching; and

Fig. 5b schematically shows part of a proposed mobile communications network using ATM links and PCM switching.

BEST MODES FOR CARRYING OUT THE INVENTION

10 Fig. 1 schematically illustrates part of a mobile communications network, e.g. a GSM network, substantially comprising the same basic components as those of Fig. 5a and 5b, but this time providing ATM links and ATM switching in the base station controller BSC itself.

15 That is, both the conventional PCM links between the mobile services switching center MSC and associated visitor location register VLR and the base station controller BSC and between the base station controller BSC and the base transceiver station BTS are replaced by ATM links. In addition, the base
20 station controller BSC as the central switching element in the base station subsystem BSS is adapted to perform ATM switching.

25 Fig. 2 illustrates a base station controller BSC as a broadband cellular network device according to a first preferred embodiment. The device comprises a base station controller unit or BSC unit 1, respectively, an asynchronous transfer mode or ATM controller 2 and an asynchronous transfer mode or
30 ATM switch 3.

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The BSC unit 1 is connected to the ATM controller 2 and may consist of a pure software, a pure hardware or a mixed software/hardware implementation of an ordinary base station controller BSC. The BSC unit 1 provides for normal base station controller functions such as handover processing, GSM signalling etc., and also decides on the individual interconnections of traffic channels or signalling channels, if necessary.

10 The main difference between this BSC unit 1 and a conventional PCM based base station controller consists in that there are no PCM group switch and corresponding controller functions in the BSC unit 1. Instead, the BSC unit 1 comprises means (not shown) for instructing the ATM controller

15 2. In this respect, the BSC unit 1 can be arranged as a pure software implementation which emulates hardware base station controller functions, or can be arranged as a mixed implementation which uses part of the hardware of an ordinary base station controller.

20 The ATM controller 2 is connected to the ATM switch 3 and thereby provides an interface for the BSC unit 1 to issue commands for connecting or disconnecting traffic channels passing through the ATM switch 3. In addition, the ATM controller 2 also provides suitable commands for the ATM switch

25 3 in order to enable the hardware thereof to establish the required connections, and may include specific original equipment manufacturers' (OEM) adaptations required to have the ATM switch 3 work properly.

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The ATM switch 3 forms the actual ATM hardware switching element. It is controlled by the ATM controller 2 either using a standardized interface like e.g. the General Switch Management Protocol (GSMP), or a corresponding proprietary solution.

ATM links coupling the ATM switch 3 to respective network elements arrive at and leave the ATM switch 3 at respective input and output ports thereof. Hence, the main function of the ATM switch 3 is to connect a virtual channel (VC) coming in at an input port to one or a plurality of virtual channels leaving at one or a plurality of output ports thereof. The port switching performed by the ATM switch 3 is, thus, capable of multicast operation, and is schematically indicated by dotted lines.

Fig. 3 illustrates the broadband cellular network device according to a second embodiment.

While the BSC unit 1 and the ATM switch 3 fundamentally correspond to those used in the above described first embodiment, the ATM controller 2 is now separated into two functional layers. It is understood, however, that the number of layers is not limited to two, but may be any number suitable for realizing the functions to be performed by the ATM controller 2.

In the shown two layer structure, the ATM controller 2 includes an upper layer 2a and a lower layer 2b. In accordance with the GSM system serving as the example mobile communications network, the upper layer 2a constitutes a GSM related

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layer caring for the conversion of signalling and other GSM related items, as shown in Fig. 3, and instructs the lower layer 2b which ports and/or virtual channels are to be interconnected or switched, respectively, in the ATM switch 3. Accordingly, the lower layer 2b will care for other, e.g. ATM switch related tasks such as maintenance and error handling of the ATM switch 3.

Fig. 4 illustrates the base station controller as the broadband cellular network device according to a third embodiment.

While the BSC unit again corresponds to that of the first embodiment, a General Switch Management Protocol (GSMP) controller 2 is employed here instead of the ATM controllers 2 according to the first and second embodiments, and the ATM switch 3 is adapted to support the GSMP used by the GSMP controller 2.

The GSMP, which has recently been published under the reference RFC1987 by the Internet Engineering Task Force, is a general purpose protocol which provides an interface for controlling a hardware based ATM switch 3. The GSMP allows a controller to establish and release connections across the ATM switch 3, to add and delete leaves on a point-to-multipoint connection, to manage the individual ports of the ATM switch 3, and to request configuration information and statistics.

According to the third embodiment, an ATM based base station controller BSC is provided comprising a combination of a base station controller unit and a GSMP switch using a GSMP con-

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troller in-between. This arrangement provides for a fast and at the same time cheap construction of an ATM based base station controller BSC. In this construction, it is possible to combine the BSC unit 1 with any kind of GSMP switch. In this manner, hardware of a variety of different manufacturers can be used, and the capacity of the underlying network can easily be scaled up when additional base transceiver stations BTS and transceivers (TRX) (not shown) are introduced into the base station subsystem BSS.

It should be understood that the above description and accompanying figures are only intended to illustrate the present invention. Thus, the device according to the invention may also be used in networks other than the GSM referred to as an example. The preferred embodiments of the invention may also vary within the scope of the attached claims.

5

10

Claims

1. A broadband cellular network device, comprising
a base station control unit (1) adapted to control the
15 distribution of asynchronous transfer mode cellular traffic
consisting of asynchronous transfer mode cells,

an asynchronous transfer mode controller (2) connected
to and being controlled by said base station control unit
(1), and

20 an asynchronous transfer mode switching means (3) con-
nected to and being controlled by said asynchronous transfer
mode controller (2) and adapted to switch asynchronous trans-
fer mode cellular traffic.

25 2. A device according to claim 1, wherein said base sta-
tion control unit (1) provides either of a software, hardware
or mixed software/hardware implementation of base station
controller functions and comprises an asynchronous transfer
mode controller instruction means adapted to instruct the
30 asynchronous transfer mode controller (2).

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3. A device according to claim 1, wherein the asynchronous transfer mode controller (2) is arranged to provide an interface for converting commands issued by the base station controller unit (1) into commands causing switching actions of the asynchronous transfer mode switching means (3).

4. A device according to claim 3, wherein the asynchronous transfer mode controller (2) is adapted to employ asynchronous transfer mode based signalling and to provide control commands for controlling connecting hardware of the asynchronous transfer mode switching means (3).

5. Device according to one of claims 3 or 4, wherein the asynchronous transfer mode controller (2) is arranged to comprise at least two functional layers, one of the functional layers being a cellular network related upper layer (2a) adapted to perform cellular network related functions, and one of the functional layers being an asynchronous transfer mode related lower layer (2b) adapted to perform asynchronous transfer mode switching means related functions.

6. Device according to claim 5, wherein the lower functional layer (2b) of the asynchronous transfer mode controller (2) is arranged to control the switching hardware of the asynchronous transfer mode switching means (3).

7. Device according to claim 3, wherein the asynchronous transfer mode controller (2) is adapted to be a General Switch Management Protocol (GSMP) controller, and wherein the asynchronous transfer mode switching means (3) is adapted to support said General Switch Management Protocol.

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8. Base station controller (BSC) for use in base station subsystems (BSS) in asynchronous transfer mode based cellular networks, comprising the broadband cellular network device according to one of the preceding claims.

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Variable	Mean	Standard deviation	Minimum	Maximum
Age	34.5	10.2	21	55
Gender	Male	10.5	0	21
Marital status	Married	10.5	0	21
Education	High school	10.5	0	21
Occupation	Unemployed	10.5	0	21
Income	Low	10.5	0	21
Health status	Good	10.5	0	21
Smoking status	Non-smoker	10.5	0	21
Alcohol consumption	Non-drinker	10.5	0	21
Exercise frequency	Low	10.5	0	21
Stress level	Low	10.5	0	21
Sleep quality	Good	10.5	0	21
Appetite	Good	10.5	0	21
Weight change	Stable	10.5	0	21
Blood pressure	Normal	10.5	0	21
Blood sugar	Normal	10.5	0	21
Cholesterol	Normal	10.5	0	21
Triglycerides	Normal	10.5	0	21
Hemoglobin A1c	Normal	10.5	0	21
Hemoglobin	Normal	10.5	0	21
White blood cells	Normal	10.5	0	21
Platelets	Normal	10.5	0	21
Red blood cells	Normal	10.5	0	21
Hematocrit	Normal	10.5	0	21
Hemoglobin	Normal	10.5	0	21
White blood cells	Normal	10.5	0	21
Platelets	Normal	10.5	0	21
Red blood cells	Normal	10.5	0	21
Hematocrit	Normal	10.5	0	21
Hemoglobin	Normal	10.5	0	21
White blood cells	Normal	10.5	0	21
Platelets	Normal	10.5	0	21
Red blood cells	Normal	10.5	0	21
Hematocrit	Normal	10.5	0	21
Hemoglobin	Normal	10.5	0	21
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Red blood cells	Normal	10.5	0	21
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Hematocrit	Normal	10.5	0	21
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Red blood cells	Normal	10.5	0	21
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Hemoglobin	Normal	10.5	0</	

[illegible]

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Fig. 1

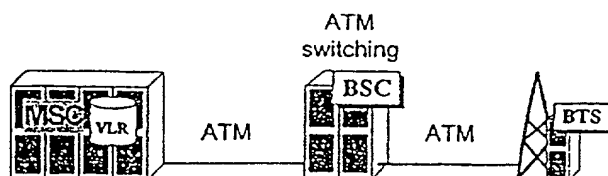


Fig. 2

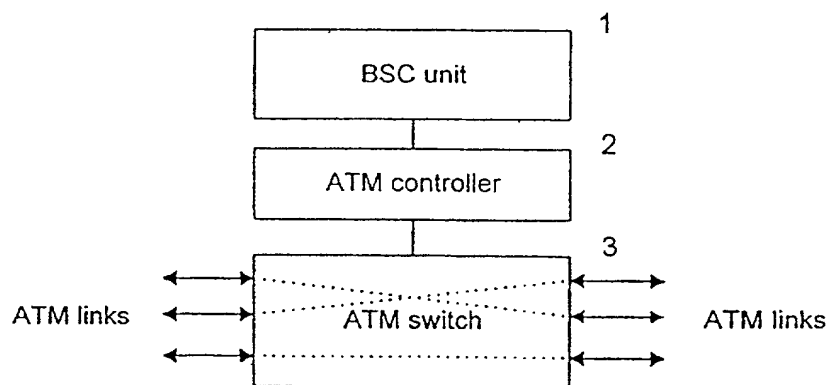
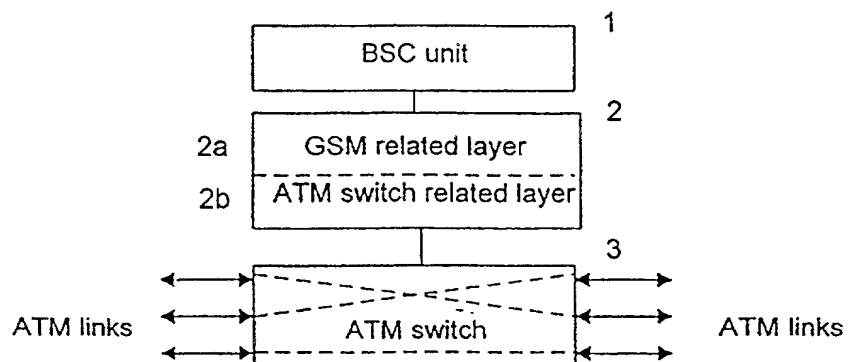


Fig. 3



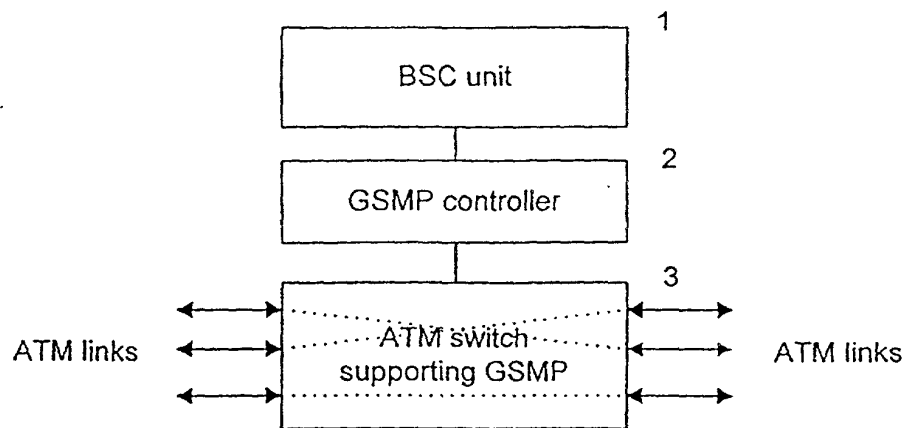
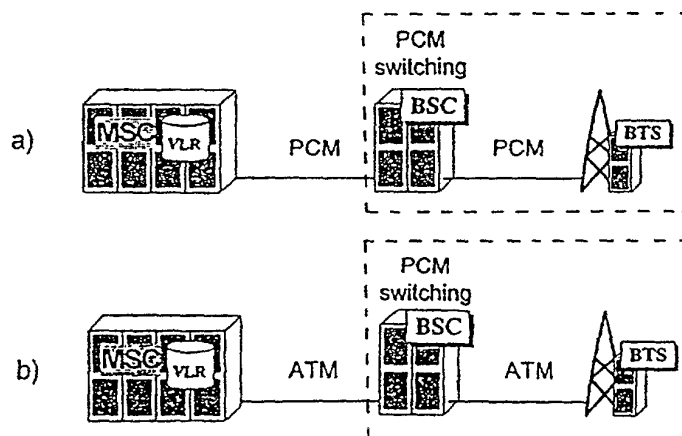
2 / 2
Fig. 4

Fig. 5



Declaration and Power of Attorney Patent Application (Design or Utility)

My residence, post office address and citizenship are as stated below next to my name,

the specification of which

- I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information know to me to be material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or 35 U.S.C. §365(b) of any foreign application(s) for patent or inventor's certificate, or 35 U.S.C. §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate of PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)		
Number	Country	Day/Month/Year Filed
Number	Country	Day/Month/Year Filed
Number	Country	Day/Month/Year Filed

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

Prior Provisional Application(s)	
Serial Number	Day/Month/Year Filing Date
Serial Number	Day/Month/Year Filing Date
Serial Number	Day/Month/Year Filing Date

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or under 35 U.S.C. §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

Prior U.S. or International Application(s)		
Serial Number PCT/EP97/07351	Day/Month/Year Filed 30 December 1997	Status (patented, pending, abandoned) Pending
Serial Number	Day/Month/Year Filed	Status (patented, pending, abandoned)
Serial Number	Day/Month/Year Filed	Status (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Mark A. Hollingsworth	Reg. No. 38,491
Michael B. Lasky	Reg. No. 29,555
Iain A. McIntyre	Reg. No. 40,337

Please direct all correspondence in this case to Altera Law Group, LLC at the address indicated below:

Full Name of Sole or First Inventor		
Family Name Ruutu	First Given Name Jussi	Second Given Name
Residence and Citizenship		
City of Residence Helsinki	State or Country of Residence Finland	Country of Citizenship Finland
Post Office Address		
Street Address Nokia Research Center P.O. Box 45	City FIN-00211 Helsinki	State & Zip Code or Country FINLAND
Signature of Inventor		Date

Full Name of Second Inventor, if any		
Family Name Martikainen	First Given Name Mikko	Second Given Name
Residence and Citizenship		
City of Residence Helsinki	State or Country of Residence Finland	Country of Citizenship Finland
Post Office Address		
Street Address Nokia Research Center P.O. Box 45	City FIN-00211 Helsinki	State & Zip Code or Country FINLAND
Signature of Inventor		Date